PROPOSAL

# Alberta Environment and Parks

# City of Leduc
# Wetland Restoration Initiative

SUBMISSION DATE: JULY 2020

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# 1 INTRODUCTION

The City of Leduc, in partnership with Associated Environmental Consultants Inc. (Associated), is proposing to complete a wetland restoration project within the City in Partnership with the Alberta Environment and Parks (AEP) Wetland Replacement Program. Under the Alberta Wetland Policy, fees were paid to Alberta Environment and Parks (AEP) through the In-Lieu Fee program for wetland impacts associated with various projects within the City of Leduc's jurisdiction. The proposed project meets the intent of compensating wetland loss through the in-lieu fee program by establishing wetlands that provide important functions on the landscape.

Restoring wetlands will provide significant ecological benefits in areas disturbed by agriculture around Telford Lake. We expect the replacement wetland will help reduce impacts related to extreme weather events (i.e. flooding and surface flow), improve water quality, support biodiversity, and provide habitat for wildlife and species at risk. The City may also provide educational opportunities for residents through information sessions and interpretive signage along an existing nature trail that exists at the site.

Our proposal to construct 0.382 ha of wetlands on City of Leduc property, within SW31-49-24W4M, is contingent on approved funding from AEP to support the detailed design and construction. The project will be managed and executed by Associated with Kristen Andersen, P. Biol., PWS, CPESC leading the wetland restoration site selection, design and construction phases. Kristen will also fulfil requirements for work to be completed by an Authenticating Professional to satisfy the requirements of section 4.0 of "Professional Responsibilities in Completion and Assurance of Wetland Science, Design and Engineering Work in Alberta" (Government of Alberta, May 1, 2017) (the Authenticating Professional).

# 2 PROJECT DESIGN AND LOCATION

## 2.1 Project Location Information

The site for wetland restoration is located on a property owned by the City of Leduc and is on the northeast side of Telford Lake (**Figure 2-1**). Telford Lake is an important natural feature and popular recreational area for residents of Leduc. There is a multi-way path along the lake, a boardwalk on the west side, multiple look-out points for bird watching, and access for boating with the Leduc Boat Club. It is bordered by residential, recreational, and agricultural lands, and provides a variety of terrestrial and aquatic habitat for numerous species. There are various wetland and forested areas on the north side of the lake. The site is within Hydrologic Unit Code (HUC) 6 watershed 110202 and HUC 4 watershed 1102.

This site was selected based on the opportunity to restore a wetland, provide wildlife habitat, improve water quality and create significant educational opportunities. The restored wetland will be located close to Telford lake, separated from the lake by a multiuse trail from which the public can easily view the wetland.

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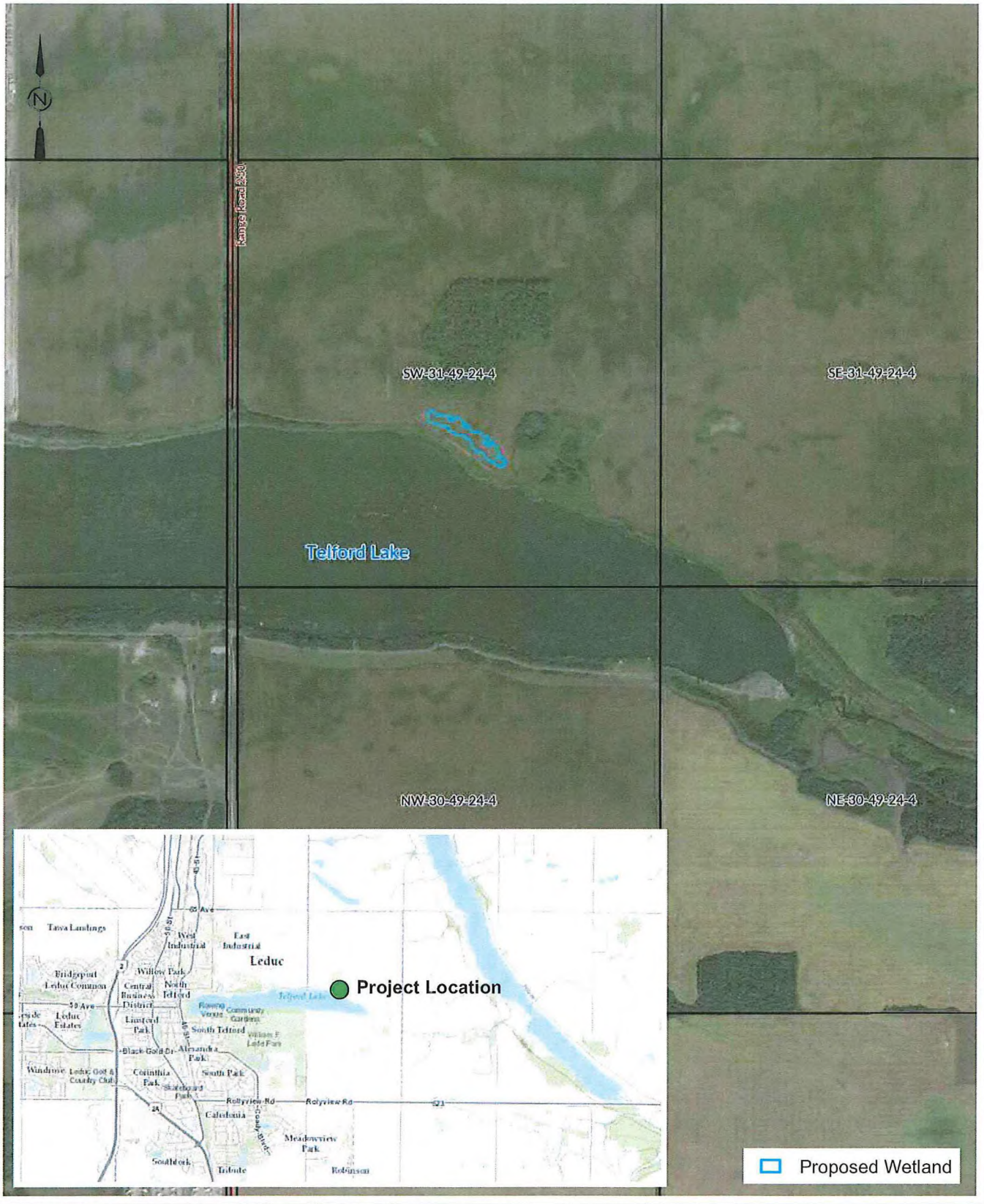


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Associated Environmental

CITY OF Leduc

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| **APPROVED** | |
| **DATE** | 2020JUL06 |
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FIGURE 2-1

CITY OF LEDUC
WETLAND RESTORATION AREAS

TELFORD LAKE
PROJECT LOCATION

## 2.2 Wetland Replacement Project Design

### 2.2.1 Wetland Restoration

The objectives of the constructed wetland include:

1. Restoring a marsh wetland with variable depths and shallow water areas.
2. Providing habitat for a diversity of amphibians, pollinators, small mammals and songbirds, reptiles, and bats.
3. Restoring habitat for a diversity of native plants.
4. Demonstrating how a naturally appearing and functioning wetland may be restored without the use of a dam, ditch plug, well, pipes, pump, diversions, or water control structure.

This project involves restoring a wetland that was historically drained for farming near Telford Lake and the community of Leduc. Signs of wetland drainage on the proposed project area include the presence of soil fill, ditches, leveled ground, shadows on historic aerial photos, ruts filled with water, and depressions where plants have died.

A restored wetland with an interspersion of shallow water and vegetation with a seasonal hydroperiod would provide habitat that is unique to the site and restore a field that's presently dominated by agronomic grasses and noxious weeds. There's also a great opportunity for habitat connectivity by restoring wetlands, shrubs, and trees between a healthy tree stand and the lake.

As the wetland to be restored is located in the flight path of the Edmonton International Airport, the wetlands would be designed to limit the attraction to waterfowl and instead focus on providing habitat for smaller birds, amphibians and mammals. Waterfowl have a variety of feeding methods but are typically drawn to wetlands with large areas of shallow open water. This provides them with opportunities to forage while avoiding predators found in upland areas. To limit waterfowl presence, the restored wetlands would be designed with minimal areas of open water and instead include significant amounts of emergent plants and shrub species, with large woody debris spread throughout the area. This design is intended to deter waterfowl as it provides ample places where their predators can hide.

The abundance of emergent plants, shrubs, and large woody debris would reduce waterfowl presence while restoring habitat for a variety of other species including amphibians, reptiles, bats, songbirds, and pollinators including bees, butterflies, and moths. The wetland would be designed to also provide breeding habitat for the Canadian toad (*Anaxyrus hemiophrys*) as well. The Canadian toad, whose habitat is threatened by the filling of wetlands across Canada, can be found breeding in temporary ponds and puddles, making the proposed wetland an ideal place for them.

### 2.2.2 Site Selection

Site selection occurred in 2020 and involved meeting with members of the City and conducting site visits. Multiple locations around Telford Lake were examined in winter and spring to identify suitable locations for restoring wetlands. Existing utilities and leases that may impact the timing of construction were identified and consultation with internal stakeholders was conducted to confirm project feasibility.

### 2.2.3 Concept Design

The restored wetland will include marsh and shallow open water habitat comprising approximately 0.4 hectares. Figure 2-2 shows the location of the proposed wetland and Table 2-1 summarizes the wetland area associated with the conceptual design.

**Table 2-1**
**Wetland Construction Area**

| Total Increase in Wetland Area (ha) |
|---|
| 0.382 |

A surface water wetland may be restored by excavating an area that receives overland drainage from the adjacent cultivated fields. Soils present at the site have a clay to silty clay texture, characteristic of soils with low permeability. Therefore, it is not necessary to import soil or use a liner to establish wetland hydrology.

Soil removed from restoring the wetland will be spread in the surrounding uplands and seeded and planted to native species of wildflowers, trees, and shrubs. Hauling soil away for off-site disposal was not included in the project budget. The site was previously recontoured as water was collecting in this area, which is adjacent to a paved trail. The restored wetland will allow greater storage of stormwater runoff and prevent water from ponding near the trail.

The restoration activities will replicate, to the extent possible, natural features of wetlands, such as shallow basins, gradual slopes, loosened soils, and diverse native plant communities. During detailed design, grading plans that include target elevations as well as detailed planting plans will be provided. Grading and planting will be consistent with the target hydroperiod, and design will include a variety of hydrologic zones to support a diversity of plant species. These design elements are based on meeting project objectives related to water quality improvement and providing habitat for target species.

Existing vegetation on the site is predominantly scentless chamomile (*Tripleurospermum inodorum*) and hairy speedwell (*Veronica peregrina*). Opposite the trail, reed canary grass (*Phalaris arundinacea*) is dominant with rough cinquefoil (*Potentilla norvegica*). Closer to the lakeshore, awned sedge (*Carex atherodes*) and common cattail (*Typha latifolia*) exist with common tansy (*Tanacetum vulgare*) on hummocks. A variety of native species known to occur in the area will be established within the wetland to be restored. Planting activities will include the installation of wetland plugs including sedges (*Carex* spp), bulrushes (*Scheonoplectus* spp), spike rushes (*Eleocharis palustris*) and other native graminoids. Native shrubs will be installed in the wetland buffer zone to create connectivity and structure. Additional planting is proposed where existing wetlands occur between the trail and the lake to limit the spread of reed canary grass and tansy into the restoration site.

The target hydroperiod will also maximize the potential for species that are expected to use the site. Wildlife features will be installed to include snags and/or coarse woody debris.

A detailed design report with drawings will be prepared following approval of this proposal. The report will include the updated construction cost estimate, construction phasing and staging, the proposed construction schedule and monitoring plan. An estimated timeline and schedules for wetland restoration activities is provided in Section 5.

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# FIGURE 2-2

CITY OF LEDUC
WETLAND RESTORATION AREAS

TELFORD LAKE
WETLAND CONSTRUCTION CONCEPT DESIGN

### 2.2.4 Regulatory Approvals

Applications for regulatory approvals will be submitted upon completion of detailed design. To meet project schedules, detailed design activities will continue while waiting for regulatory approvals. We anticipate that required approvals may include, but not be limited to, the following:

- *Water Act* Code of Practice Notification;
- *Historic Resources Act* Approval where HRV lands exist.

### 2.2.5 Construction

Construction will be put out to tender through the City's supply chain management. Construction phase services will include:

- Tendering as required;
- Construction oversight;
- Heavy equipment;
- Supply and installation of plant material;
- Supply of coarse woody debris and/or snags; and
- Erosion control.

Equipment to be used for this project will ideally include an excavator and skid steer. The Excavator should be a John Deere 210G equivalent or larger with a bucket width of 1500 mm or larger. Additionally, a Dozer will be required to include a Caterpillar D6R LGP or equivalent and a blade width of 3 metres or wider.

All work would occur under the direct supervision of personnel with training and experience in wetland restoration and construction.

## 2.3 Ownership and Land Uses

The site is privately owned and no public lands exist on the site. No landowner approval is required for this project as the work will take place on City-owned land.

The site was formerly under agricultural use (annual crop production) but was acquired by the City and made available for public use as part of the park system. Recent earthwork occurred to regrade the area where ponding created trail maintenance concerns. Farming continues in the fields upgradient of the site. Current land use is summarized in **Table 2-2** below.

**Table 2-2**
**Current Land Use**

| Area | Land use |
|---|---|
| Upland zone of influence | Annual crop production |
| Wetland edge | Other - recreational use as multiuse trail within park |
| Within the wetland | Generalized soil disturbance; Fallow, no cultivation or livestock for 2 to 10 years |

# 3 ECOLOGICAL SUITABILITY

## 3.1 Hydrology

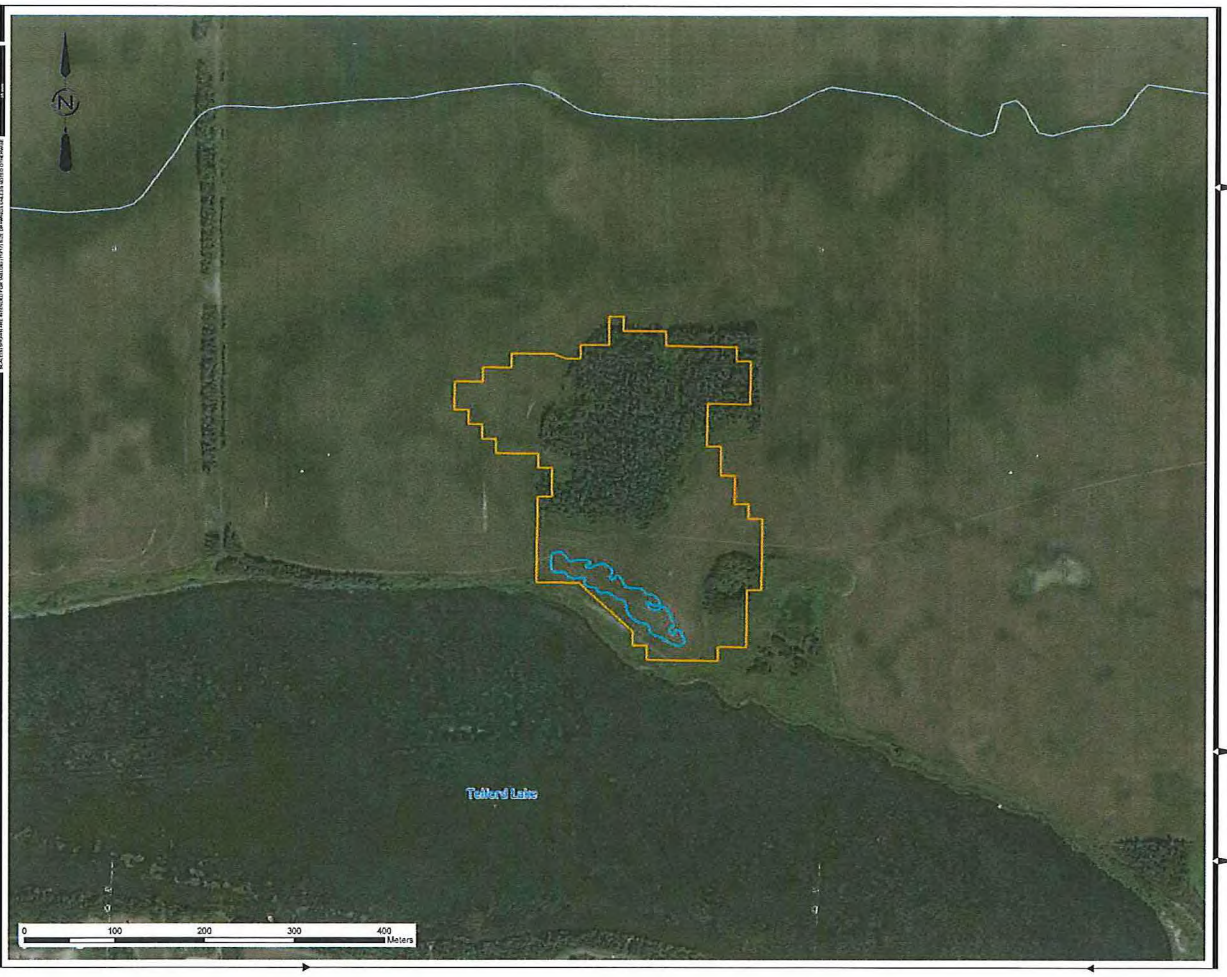
Elevation and watershed data were used to determine the direction of surface water flow within the catchment associated with the proposed wetland (Figure 3-1).

The restored wetland will have no defined inlets or outlets. The source of water is overland flow from the agricultural areas to the north. Classifications of the state of surface water permanence in the deepest part of the wetland in most years for the proposed wetland is outlined in Table 3-1.

The site was farmed prior to the availability of historic imagery. Therefore, the normative state cannot be confirmed.

**Table 3-1**
**Water Regime Classifications**

| State | Water Regime Classification |
|---|---|
| Normative State (prior to anthropogenic disturbance) | - seasonally flooded (5 – 17 weeks flooded) |
| Current State | - not flooded (less than 1 week flooded) |
| Post-Replacement state | - seasonally flooded (5 – 17 weeks flooded) |




Associated Environmental

LEGEND:

- Proposed Wetland
- Catchment Area
- Watercourse

CITY OF Leduc

FIGURE 3-1

CITY OF LEDUC
WETLAND RESTORATION AREAS

TELFORD LAKE
DRAINAGE DIRECTION AND CATCHMENT

| | |
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## 3.2 Soils

Soils in this area are classified as moderately well-drained Black Solodized Solonetz, developed on medium textured softrock parent material and well-drained Eluviated Black Chernozems developed on moderately fine-textured till parent material (GoA 2016a)[1]. According to the Soil Landscapes of Canada[2], the area is in polygon 72700931 and is dominated by Chernozems.

Topsoil depth ranges from 7 to 40 cm. Soil fill was imported to site. Subsoils underlying the topsoil have a clay and silty clay texture.

## 3.3 Wetland Connectivity

Adjacent land to the east is privately owned and leased to the City for annual crop production. Land to the west is owned by the City and used for annual crop production. Telford lake is located directly south of the proposed wetland location. A map showing the approximate boundaries of any existing wetlands within 800 m of the project area is shown in **Figure 3-2**. **Table 3-2** below summarizes the wetland connectivity data.

A Google Earth photo taken of the area on May 10, 2007 shows the shadows of numerous drained wetlands within and surrounding the proposed restoration project **Figure 3-3**. This project may open the door for the restoration of farmed wetlands on adjacent lands in the future.

Existing buffers with native perennial vegetation adjoining the proposed wetland restoration site are lacking due to historic cultivation around Telford lake. Immediately adjacent to the site, scentless chamomile is the dominant species. Across the trail, reed canary grass is the dominant species.

**Table 3-2**
**Wetland Connectivity Information**

| Parameter | Area / Distance |
|---|---|
| Total area of wetlands within 800 m radius | 5.9 ha |
| Mean distance from the center of proposed wetland to nearest 5 wetlands | 245 m |

[1] Government of Alberta (GoA). 2016a. Alberta Soil Information Viewer (AGRASID). Polygons 14266, 14269, 14271, and 28188. Landform Report: Alberta Agriculture and Rural Development https://soil.agric.gov.ab.ca/agrasidviewer/. Accessed 25 July 2019.

[2] Government of Canada. 2020. Soil Landscapes of Canada Version 3.2. https://open.canada.ca/en/open-government-licence-canada.

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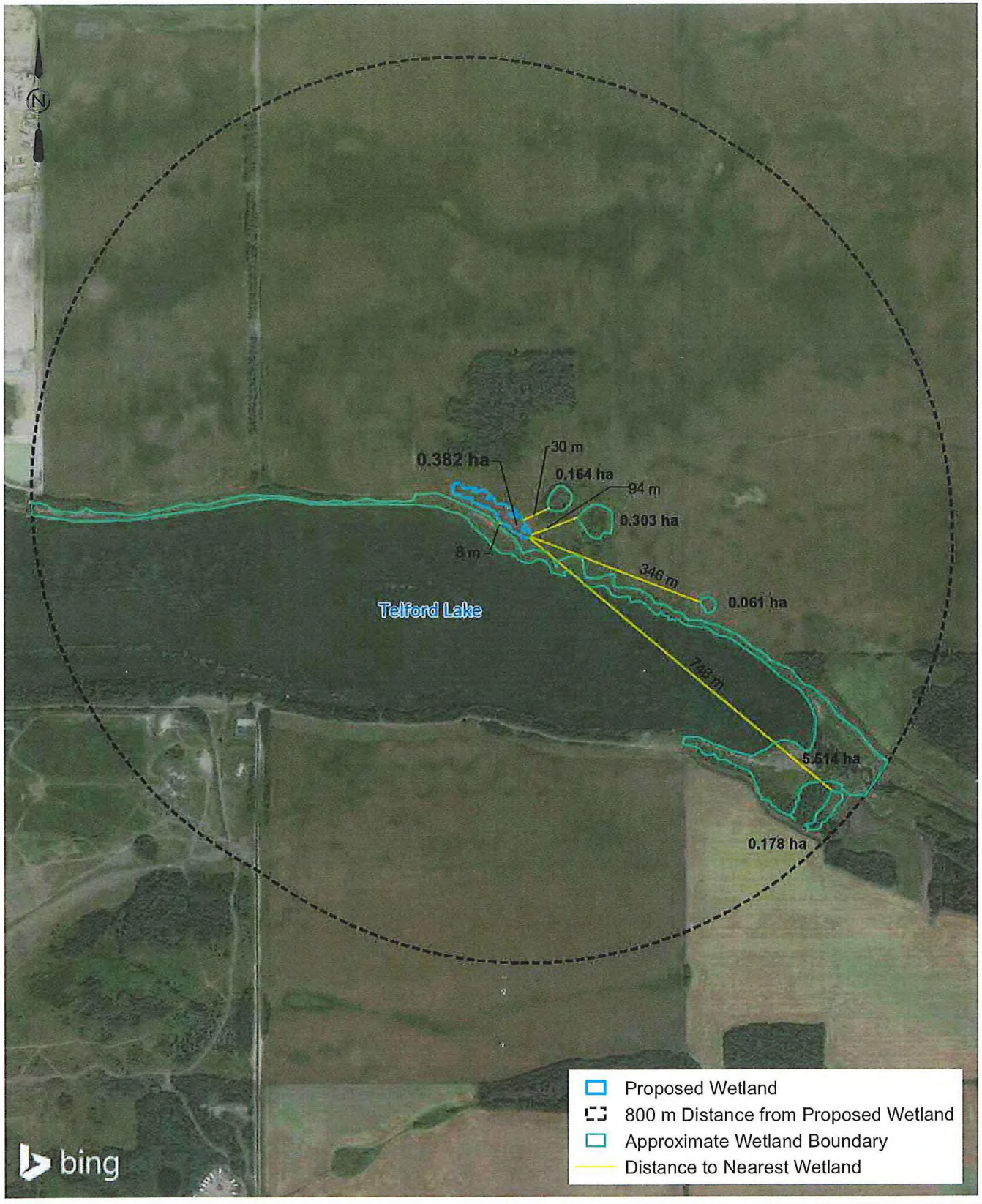


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FIGURE 3-2

CITY OF LEDUC
WETLAND RESTORATION AREAS

TELFORD LAKE
WETLANDS WITHIN 800 M
OF PROPOSED WETLANDS


**Figure 3-3**
**Google Earth Image taken on May 10, 2007**

## 3.4 Wetland Diversity

The site is currently non-wetland. The soils have been leveled and compacted, providing conditions that are ideal for the growth of weed species, erosion, and increased surface water runoff towards to lake. Post-replacement wetland zones will include a variety of water depths ranging from 0 to 50 cm to support species diversity and to maximize water quality improvement functions. The dominant wetland zone is expected to include water depths between 0 to 15 cm in depth. The wetland basin will be shaped to contain loosened soils with pit and mound topography to increase plant diversity and reduce colonization by reed canary grass and cattails. The target wetland hydroperiod is seasonally flooded (5 – 17 weeks flooded). These details will be confirmed during detailed design. The proposed wetland is expected to be a marsh as shallow open water is expected to comprise less than 25 percent of the overall wetland area mid-summer.

The site is ideal in terms of the presence of soils high in clay, shallow basins, gradual slopes, and the fact that it is accessible by the public, and it's highly visible. It's also well-suited for wetland restoration based on the ability to create a marsh that is seasonally flooded (5 – 17 weeks flooded), whereby most wetlands with this hydroperiod were drained years ago and are less common on the landscape.

## 3.5 Project Constraints

Non-native plant species will be an important consideration during project planning, construction and maintenance. Reed canary grass is an invasive species present in the ditch and has the potential to become dominant in the restored wetland. In addition, common tansy is also present around Telford Lake. Scentless chamomile, a noxious weed was identified within and adjacent to the proposed wetland restoration area in dense populations. Careful planning and vigorous maintenance before and following construction will be required to prevent infestations of non-native species. It is anticipated that mechanical weed control will be required monthly during the growing season following installation for 3 to 5 years while the installed plants become well established.

Based on a search of the Alberta Conservation Information Management System on June 17, 2020 (ACIMS 2020)[3], there are no recorded sensitive element occurrences, designated protected areas, or Crown reservations/notations in the project area.

The City of Leduc is located within a region of Alberta that is prone to clubroot infestations. Compliance is required under the Agricultural Pests Act (R.S.A, 2000, c. A-8) and best management practices should be followed during construction to prevent the spread of this disease.

The site falls within a Historical Resource Value 5 Listing, high potential lands. Historic Resource Act clearance will be required and monitoring during construction may be a requirement of the approval increasing required costs to complete the project.

[3] Alberta Conservation Information Management System (ACIMS). 2020. Available online at: https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/search-acims-data/. Accessed June 17, 2020.

# 4 PROJECT SCHEDULE AND DELIVERABLES

The detailed design phase will begin upon approval of this proposal and be completed in August 2020. Regulatory applications will be submitted concurrently, and construction will take place in October. Monitoring will take place over 4 years following construction (2021 through 2024). This schedule is summarized in Table 4-1.

**Table 4-1**
**Key milestone dates**

| Program Component | Schedule |
|---|---|
| Site Assessment and Surveys | July 2020 |
| Landowner Agreements | N/A – Land is owned by the City of Leduc |
| Detailed Wetland Replacement Design Plan | August 2020 |
| Relevant Authorizations and Permits | August 2020 |
| Construction Work | October 1- October 15, 2020 |
| Vegetation Planting | October 1- October 15, 2020 |
| Inspection of Post-Construction work and submission of As-Built plans | October 31, 2020 |
| Annual monitoring (including # of years of monitoring required) | Growing season of 2021 (1 year) is a requirement and reimbursable through the Wetland Replacement Program; 4 subsequent years of monitoring is recommended to take place |
| Other key requirements | Long term monitoring and contingency actions 2021-2024 (not included in the cost estimate and to be based on additional funding through WRP) |

Deliverables to be generated under each phase of the program are summarized in the following table.

**Table 4-2**
**Restoration Program Component Deliverables**

| Program Component | Deliverable | |
|---|---|---|
| **Design** | Annual Proposal with Site Selection and Concept Designs<br>Design Report and Drawings<br>Detailed Design Drawings<br>Approvals Package | Monthly and Annual Progress reports |
| **Construction** | Tender document as required<br>Construction monitoring reports | |
| **Monitoring** | Annual Monitoring Reports which summarizes the progress of the site towards meeting objectives, documents conditions, maintenance and adaptive management. | |

# 5 ESTIMATED PROJECT COSTS

The estimated cost for each phase of work is summarized in Table 5-1 and construction costs are further outlined in Appendix A. The cost estimate will be updated during the detailed design phase.

Table 5-1
Estimated Wetland Design and Construction Costs

| Item | Total Cost |
|---|---|
| Construction Fees | $175,215 |
| Professional Fees | $64,900 |
| Total | $240,115 |
| Cost per hectare | $628,570 |

## 5.1 Activities and Infrastructure Outside of Wetland Boundary

Planting within a 10 m buffer zone is proposed as part of this project. The present ecological condition of the buffer is severely degraded due to the history of farming. Compact soil and predominance of noxious weeds exist. Controlling non-native plants, loosening compacted soils, and planting native species in the buffer will improve the functions provided by the wetland. Specifically, it will support wetland-dependent wildlife in this important wildlife area, increase water quality improvement functions by filtering runoff received by the wetland, and reduce the potential for weed infestations.

# 6 PROJECT TEAM

## 6.1 Key Team Members

**Kristen Andersen, PWS, P.Biol., CPESC.**
**Senior Wetland Scientist**
Kristen is a senior wetland scientist and restoration ecologist with 23 years of professional experience as an environmental consultant. She specializes in the design, installation and monitoring of wetland creation and restoration projects as well as wetland delineation, functional assessment, and remote sensing. Kristen is passionate as an educator and has been teaching wetland courses at the University of Alberta since 2010 including a course on wetland restoration and construction. She also teaches stream restoration workshops for stewardship groups and municipalities. Kristen's background includes stormwater management and erosion and sediment control design and installation, including the establishment and execution of environmental monitoring with a focus in water quality. Kristen is recognized under the Alberta Wetland Policy as an authenticating professional for all categories (Wetland Assessment and Impact Reports, Replacement Design and Monitoring Plans, Validation, and Verification).

**Suzanne Card, M.Sc., P.Biol. P.Ag,**
**Senior Wetland Ecologist**
Suzanne has successfully managed multiple projects, ranging in size and complexity, for industry, developers, and local governments. Suzanne is a senior environmental scientist with ten years of experience in environmental consulting. She has extensive experience in wetland and vegetation ecology, including wetland delineation and classification, and soil, eco site, invasive species, and rare plant assessments. Suzanne has successfully managed biophysical assessment projects for ASP projects for developers. Suzanne is recognized under the Alberta Wetland Policy as an authenticating professional for all the Wetland Assessment and Impact Reports category.

**April Ziegler, P.Biol**
**Project Manager and Regulatory Lead**
April is an Environmental Scientist and Professional Biologist with a focus on environmental regulatory compliance and environmental assessment. As part of the regulatory team, April works closely with the project team, bridging the gap between project managers and regulators at the municipal, provincial, and federal levels. She has extensive experience applying for and obtaining approvals for wetland projects.

**Akinbola George, M.A.Sc., P.Eng., PMP**
**Hydrological and Hydraulic Modeler**
Akinbola is a Senior Water Resources Engineer with over 17 years of experience in water resource planning. His areas of expertise include watershed flood mapping; flood forecasting; hydraulic structures; dam break analysis; environmental impact assessments; watershed hydrological processes; river hydraulics; ice hydraulics; sediment and erosion control; and hydropower development and analysis. Akinbola will develop a water budget for the site and its drainage area and provide design specifications to achieve the desired hydrological function of the wetland.

**Thomas R. Biebighauser**
**Wildlife Biologist and Wetland Ecologist**
Tom Biebighauser has restored over 2,500 wetlands and streams across Canada, in 26-States, New Zealand, Puerto Rico, and Taiwan since 1979. He retired in 2013 after working 34-years for the USDA Forest Service as a Wildlife Biologist, where he started wetland and stream restoration programs across the United States. Tom has served as an

instructor for the British Columbia Wildlife Federation Wetlands Institute for 16-years, restoring over 250-wetlands and streams across Alberta and British Columbia since 2003. Having built over 1,400-dams, he has since decommissioned over 300 -dams. Tom learned about drainage and irrigation from contractors who spent their lives destroying wetlands. Tom has developed highly effective and low-cost techniques for building wetlands and streams for rare species across North America. He builds habitats that require little, if any maintenance, and do not involve the use of diversions, dams, dikes, pipes, or pumps. Tom has written 4-books about wetland restoration and instructs online college and field courses on the topic. He received the United States National Wetlands Award for Conservation and Restoration in 2015.

Alberta Environment and Parks

# CLOSURE

The City of Leduc would like to thank Alberta Environment and Parks for the opportunity to provide this work plan and fee estimate to complete wetland restoration within Leduc. If you have any questions related to the information provided, please contact the undersigned at 780-980-8415 or by email at kvansteenoven@leduc.ca.

Yours truly,

Kyle van Steenoven, P.Eng.
Acting Director of Engineering

# APPENDIX A - CONSTRUCTION COST ESTIMATE

| City of Leduc Project | Working Days to Build | Start Date | Completion Date | Area (m²) | Production rate / hour per machine | Total Heavy Equipment Hours Needed | Excavator Hours | Excavator Cost | Dozer Hours | Dozer Cost | Rock Needed (m³) | Rock Cost | Wetland Plugs $2.75/ea | Buffer Poplar Live Staking $40/ea | Buffer Shrubs $40/ea | Native Plant Seed Cost | Heavy Equipment Contract Supervision Hours | Heavy Equipment Contract Supervision Cost | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Fees** | | | | | | | | | | | | | | | | | | | |
| **Wetland Restoration** | **21 (earthwork & planting)** | **1-Oct** | **21-Oct** | 3820 | 50 | 76 | 38 | $9,310 | 38 | $8,740 | 0 | $0 | $31,518 | $0 | $0 | $2,292 | 38 | $11,052 | $62,912 |
| **Subtotal** | | | | | | | | | | | | | | | | | | | **$62,912** |
| **Activities and Infrastructure Outside of Wetland Boundary** | | | | | | | | | | | | | | | | | | | |
| **Buffer Planting (10 m buffer)** | | | | 4567 | 50 | 91 | 24 | $5,880 | 30 | $7,003 | 0 | $0 | $0 | $16,000 | $60,284 | $2,740 | 24 | $7,396 | $99,303 |
| **Subtotal** | | | | | | | | | | | | | | | | | | | **$99,303** |
| **Delivery and Mobilization** | | | | | | | | | | | | | | | | | | | |
| **Woody debris purchase & delivery** | | | | | | | | | | | | | | | | | | | $8,000 |
| **Excavator Mobilization** | | | | | | | | | | | | | | | | | | | $2,500 |
| **Dozer Mobilization** | | | | | | | | | | | | | | | | | | | $2,500 |
| **Subtotal** | | | | | | | | | | | | | | | | | | | **$13,000** |
| **Subtotal Construction Fees** | | | | | | | | | | | | | | | | | | | **$175,215** |
| **Professional Fees** | | | | | | | | | | | | | | | | | | | |
| **Site Selection** | | | | | | | | | | | | | | | | | | | $5,000 |
| **Landowner Negotiation** | | | | | | | | | | | | | | | | | | | N/A |
| **Site Assessment** | | | | | | | | | | | | | | | | | | | $4,000 |
| **Design Drawings** | | | | | | | | | | | | | | | | | | | $10,000 |
| **Design Report** | | | | | | | | | | | | | | | | | | | $13,000 |
| **Water Act - Code of Practice Notification** | | | | | | | | | | | | | | | | | | | $2,400 |
| **Historical Resources Act - Clearance** | | | | | | | | | | | | | | | | | | | $4,400 |
| **Public Lands Act - Temporary Field Authorization** | | | | | | | | | | | | | | | | | | | $0 |
| **Project/Construction Administration** | | | | | | | | | | | | | | | | | | | $11,700 |
| **Inspection of as-built** | | | | | | | | | | | | | | | | | | | $3,600 |
| **Monitoring** | | | | | | | | | | | | | | | | | | | $10,800 |
| **Subtotal Professional Fees** | | | | | | | | | | | | | | | | | | | **$64,900** |
| | | | | | | | | | | | | | | | | | | **Grand Total** | **$240,115** |

**City of Leduc Wetland Restoration Project**

The prices listed are estimates based on similar projects that have been completed

The Production Rate per machine applies to wetland areas excavated, and is based on similar wetland projects

Total Heavy Equipment Hours Needed = Area to be excavated/production rate per machine

Excavator is equivalent to a Caterpillar 320DL

Dozer is equivalent to a Caterpillar D6T LGP

Large woody debris to be placed in wetlands will be obtained offsite, and delivered by truck to the worksite.

Heavy Equipment Contract Supervision Hours by Kristen Andersen = # Dozer hours and includes expenses for travel, lodging, and survey equipment

Cost of concept design as required for the project proposal is included in professional fees above in relevant categories.

Cost estimate includes approximately $240,115 to establish 1 wetland totalling a minimum of 3820 square metres; this equates to $628,573 / ha

Monitoring 1st growing season after construction will include a site visit and delivery of a technical memo

Costs for long term monitoring and contingency actions are not included above but are key to the adaptive management program; it is anticipated that the WRP funding will be made available to cover these costs.

# APPENDIX B - PHOTOGRAPHS

**Photo 1: Proposed wetland restoration site, facing west.**

**Photo 2: Standing water and tire ruts at proposed wetland restoration site**

**Photo 3: Native tree stand and farmed field to northwest of proposed wetland restoration site**

**Photo 4: Proposed wetland restoration site following topsoil placement and recontouring, facing west**